

Remarks

The Applicant thanks the Examiner for the examination of the present application for U.S. Patent.

Prior to this amendment, claims 1-13 were pending in this case. The pending Office Action rejected the claims, asserting, in pertinent part, that:

(1) Claim 5 lacks antecedent basis for the phrase "the migratory additive" (this has been attended to by the present Amendment);

(2) Claim 11 appears to be included within the context of claim 10 (this has been attended to by the present Amendment, canceling claim 11 and adding a period "." at the end of claim 10);

(3) Claims 1, 2 and 12 are rejected under 35 USC 102(b) as being allegedly anticipated by Stolk '445 (U.S. 6,063,445) (see discussion below re: this and the other rejections over prior art);

(4) Claims 1, 3, 5, 7-8, 10 and 12-13 are rejected under 35 USC 102(b) as being allegedly anticipated by Chang et al '611 (U.S. 6,503,611);

(5) Claims 1-3, 5, 7-8, 10 and 12 are rejected under 35 USC 102(b) as being allegedly anticipated by Chang et al '822 (U.S. 6,902,822);

(6) Claims 4 and 9 are rejected under 35 USC 103(a) as being allegedly unpatentable over Chang et al. '822 (U.S. 6,902,822);

(7) Claims 6 and 11 are rejected under 35 USC 103(a) as being allegedly unpatentable over a combination of Chang et al. '822 (U.S. 6,902,822) in view of Creekmore et al. (U.S. 4,112,158).

Rejection of claims 1, 2 and 12 as allegedly anticipated by Stolk '445:

It is noted that in order to maintain an anticipation rejection under 35 U.S.C. 102(e), a single reference must identically disclose each and every feature of the claim. The Applicant respectfully points out that this is not the case here, when the teachings of Stolk are compared with the recitations of claims 1, 2 and 12, when each such claim is read in its entirety.

The Action in particular asserts that Stolk discloses a "thick polymer film having a thickness of less than 1 mil comprising polyester terephthalate material (column 3, lines 52-55; column 5, lines 9-11, 41-42 and column 6, lines 4-5, 29-30)."

However, neither the above-noted portions of Stolk nor any other portions of Stolk teach or suggest the entire combination of features recited in the claims, including

amended claim 1 and its dependent claim 12, as well as amended claim 2, when those claims are read in their entireties.

In particular, claim 1 has been amended hereby to add the recitation of a migratory additive comprising a blend of secondary amides about 1 part oleic palmitamide and 1 part stearyl erucamide.

Neither Stolk nor the other references cited in the Action, taken separately or in combination, teach the combination of features of amended claim 1 (and its dependent claim 12), and thus the Applicant respectfully requests that the anticipation rejection be withdrawn. Moreover, Stolk is directed to etching porosity into a plastic's surface, and has nothing to do with the problems solved by the present invention.

Similarly, Stolk does not teach the entire combination of features required by amended claim 2, i.e., a thin polymer film between about 0.2 and 20 mils thick and preferably between 1 and 6 mils thick comprising:

one or a blend of non-polyolefin resins including but not restricted to any of polyamide 6, polyamide 6,6, or polyester terephthalate resins, having opposed first and second surfaces.

In summary, Stolk neither teaches nor suggests the combination of features required by the claims as amended herein, and thus the amended claims distinguish patentably over Stolk.

Rejection of claims 1, 3, 5, 7-8, 10 as allegedly anticipated by Chang '611:

The Action asserts that Chang '611 discloses a "polymer film comprising polymer resin and a printed surface (column 2, lines 40-49) comprising at least two layers, having a first polyolefin-based resin layer and a second polyolefin mixed resin layer having a first and second additive material and stable slip and coefficient of friction (COF) properties (column 2, lines 15-35). Chang further teaches the film comprises polypropylene and fatty amides such as erucamide and stearamide (column 1, lines 10-15, 28-35; column 3, lines 7-10 and column 4, lines 31-40). The film has a thickness of 12um (.472 mils) (column 3, lines 40-50)."

While Chang '611 discloses multi-layer polymer films, it does not teach the entire combination of features required by amended claims 1, 3 and 7, or their dependent claims 5, 8 and 10. As noted, the independent claims 1, 2, 3 and 7 have been amended to recite a migratory additive comprising a blend of secondary amides about 1 part oleic palmitamide and 1 part stearyl erucamide. Chang does not teach or suggest this, and in

fact, Chang teaches away from migratory additives, stating that his invention is the use of only non-migratory additives to achieve coefficient of friction. In contrast, the Applicant teaches and claim migratory additives, as set forth in the claims and noted repeatedly in the specification and in the drawings (which depict migration). Rather than use a non-migratory additive, as in Chang, the Applicant has solved prior art problems associated with the use of migratory additives, including a reduction in the tendency to transfer.

It should also be noted that the cited Stolk and Creekmore references also do not teach these combinations of features. Stolk is directed to etching porosity into a plastic's surface, and has nothing to do with the problems solved by the present invention. Creekmore teaches that the use of the fatty acid amides is exclusively for anti-blocking purposes, and there is no mention of surface modification to effect the frictional aspect of the film. Anti-blocking purposes and COF purposes are separate and different: the ASTM (American Society for Testing and Materials) provides separately defined terms and tests for COF and for blocking. In particular, ASTM's D1894, Standard Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting - defines "coefficient of friction as the force, usually gravitational, acting perpendicular to the two [film] surfaces in contact. This coefficient is a measure of the relative difficulty with which the surface of one material will slide over an adjoining surface or itself." In contrast, ASTM's D3354, Standard Test Method for Blocking Load of Plastic Film by the Parallel Plate Method, defines blocking "unwanted adhesion existing between layers of plastic film...Adhesion of the touching surfaces induced by temperature or pressure, or both." Also with regard to Creekmore, there is no teaching in Creekmore with regard to frictional properties; and there is not teaching of a blend of primary and second in the range of COFs described and claimed by the Applicant.

With regard to Chang '611, since Chang '611 lacks features of the noted claims, an anticipation rejection of the noted claims cannot be based on Chang '611, and the Applicant respectfully requests that this ground of rejection be withdrawn.

Rejection of claims 1-3, 5, 7-8, 10 and 12 as allegedly anticipated by Chang '822:

The Action asserts that Chang '822 discloses a "polymeric film comprising polypropylene and has a stable coefficient of friction (COF) (column 1, lines 11-17, 63-7 and column 2, lines 48-64) along with a polyolefin film comprising at least two layers, where the first layer comprises a first additive material containing up to 800 ppm of fatty

amides including stearamide or erucamide and the second additive material in the amount of less than 1000 ppm (column 2, lines 1-33). The film has a thickness of 0.7 mils (column 3, lines 30-35 and column 4, lines 25-30, 43-45). It is inherent for the film of Chang to have the structures as in claims 4 and 9 since the primary amide is erucamide and the secondary amide is stearamide. The claiming of a new use, new function or unknown property which is inherently present in the prior art does not necessarily made the claim patentable . . . The Patent Office can require applicant to prove that subject matter shown to be in prior art does not possess characteristic[s] relied on where it has reason to believe that functional limitation[s] asserted to be critical for establishing novelty in claimed subject matter may be inherent characteristic of prior art . . . "

While the Action asserts that it is "inherent for the film of Chang to have the structures as in claims 4 and 9", there is no basis for such an assertion, which appears to be an attempt to use the doctrine of inherency to find support for structures positively recited in the claim that are entirely absent from any teaching of Chang '822. Moreover, there appears to be no basis to extend that allegation to a rejection of claims 1-3, 5, 7-8, 10 and 12.

In particular, the assertion in the Action that "the secondary amide [in Chang '822] is stearamide" is chemically inaccurate. In accord with the accepted technical definitions of a primary amide vs. a secondary amide, stearamide is a primary amide, as is erucamide, oleamide and behenamide. In chemical terms, a primary amide has 2 hydrogens attached to the nitrogen in the amide functional group, a secondary amide has a single hydrogen attached to the nitrogen in the amide group (having one hydrogen being substituted in the present invention by a oleyl or stearyl group making the molecule twice as large), and a tertiary amide has no hydrogens attached to the amide group, both hydrogens having been substituted for by a different type of atom, whether a chlorine, bromine or alkane group.

See, e.g., Morrison and Boyd, "Organic Chemistry", Allyn and Bacon Press, Inc., 3rd Edition, 1979. Pages 727 and 756 attached hereto respectively show the general nomenclature of primary, secondary and tertiary amines and the conversion of these amines by acid chloride to the respective primary, secondary and tertiary amides.

The Applicant's specification and claims are written in accordance with generally accepted organic chemistry nomenclature, and the claims are properly read in that light.

This is an important point of differentiation of the Applicant's claims over Chang '822, because Chang '822 does not teach or suggest any usage of secondary amides in his formulation – only a generic "fatty acid". The term "fatty acid" is not specific enough to constitute a teaching or suggestion of a secondary amide, any more than the term "hydrocarbon chain" (for example), because the term "fatty acid" is chemically too generic a term, encompassing fatty acids that would work in Chang's application, fatty acids that might work and fatty acids that clearly would not work. (The diagram attached at the end of this Amendment illustrates this point with various organic molecules. In fact, stearyl erucamide is derived from the chemical reaction of stearic acid with erucamide, yielding entirely different chemistries, with the molecular weight of the stearyl erucamide being 590, oleyl palmitamide being 506, stearamide being 284, oleamide being 283 and erucamide being 338.)

Simply put, Chang '822 never even mentions the use of a secondary amide, such as stearyl erucamide or oleyl palmitamide, and never teaches or suggests the claimed use of a blend of the high molecular weight secondary amides in the 500-600 range (C30-C36 carbons) with the lower molecular weight primary amides in the 250-350 range (C18-C24). Thus, critical elements of the Applicant's claims are entirely absent from the teachings of Chang '822, and an anticipation rejection cannot properly be maintained on this basis.

In fact, all of the references cited in the Action, taken separately or in combination, fail to teach or suggest the combinations of features required by the claims, and fail to show any awareness of the unique chemical interaction that occurs between the secondary amide and the primary amide in the claimed invention. The larger molecular weight secondary amides, with their limited mobility and only one free hydrogen, show no indication of being able to form hydrogen to oxygen bonding with neighboring secondary amides. When examined by infrared spectroscopy, the oleyl palmitamide molecule in such a film shows only one hydrogen-nitrogen peak at 1648 cm⁻¹. (An interaction with a neighboring secondary amide would show up as a second peak due to the shift in energy as the hydrogen forms a weak bond with a neighboring oleyl palmitamide molecule. This is true for stearyl erucamide, stearyl behenamide, etc.)

In the primary amide, erucamide or, for example, oleamide, the smaller molecular weight and the presence of two hydrogen atoms allows significant levels of hydrogen to oxygen weak bonding with neighboring erucamide or oleamide molecules. This is observed in the formation of two new peaks on the FT-IR at 1650 and 1638 cm⁻¹ in

addition to the 1648 cm^{-1} peak. But this is still a very mobile molecule, which does not bond very well to the surface of the polymeric film and is thus prone to slip transfer, solvent dissolution or other types of mechanical or chemical slip removal.

In the claimed invention, however, the primary amide, erucamide or oleamide, will form hydrogen to oxygen bonds to the less mobile neighboring oleyl palmitamide when used in a blend. The higher molecular weight oleyl palmitamide then acts as an anchor to better secure the erucamide (or oleamide) to the surface of the polymeric film by chemically bonding by hydrogen to oxygen atoms and anchoring the normally mobile erucamide (or oleamide) at the surface. This phenomenon is what reduces the slip transfer or removal of the primary amide from the film, helping the film retain its coefficient of friction or surface lubricity. This can be observed by infrared spectroscopy. While the larger molecular weight secondary amides are still considered migratory, as are the primary amides, they have a significantly slower bloom rate than the primary amides, in the range of days or even weeks, as opposed to hours. The lower molecular weight primary amides help speed the bloom rate of the secondary amides, and thus they are mutually complimentary to one another, such that the claimed combination offers unique properties not provided by either component by itself, and neither taught nor suggested by the cited references.

In summary, claims 1, 2, 3, 5, and 7 (and by extension dependent claims 8, 10 and 12) have been amended herewith as discussed in detail above, and Chang '822 does not teach or suggest the complete combination of features recited in amended claims 1, 2, 5 and 7 or their dependents 8, 10 or 12, as would be required to maintain an anticipation rejection. The Applicant thus respectfully requests that this ground of rejection be withdrawn.

Rejection of claims 4 and 9 as being allegedly obvious in view of Chang '822:

The Action admits that "Chang does not explicitly disclose the ratio of the primary amide and secondary amide"; but then goes on to allege that: "The ratio of the primary and secondary amides are an optimizable feature. It would have been obvious to one of ordinary skill in the art to optimize the components because discovering the optimum or workable range involves only routine skill in the art. The ratio of the primary and secondary amides directly affect the surface smoothness of the polymeric film."

The Applicant respectfully disagrees. Just as was discussed above in connection with the preceding alleged ground of rejection, Chang '822 simply does not

disclose the use of a secondary amide. It is chemically inaccurate to describe stearamide, which is a primary amide, as a secondary amide. In fact, as noted above, Chang '822 never even mentions the use of a secondary amide, such as stearyl erucamide or oleyl palmitamide, and never teaches or suggests the claimed use of a blend of the high molecular weight secondary amides in the 500-600 range (C30-C36 carbons) with the lower molecular weight primary amides in the 250-350 range (C18-C24).

In addition, the Applicant respectfully disagrees with the assertion that the "ratio of the primary and secondary amides directly affect the surface smoothness of the polymeric film." That is not the case, since adding the particular amides imparts surface lubricity to the films, not surface smoothness, and in fact can be seen from scanning microscopic photographs to roughen the surface as they form imperfect crystals on the surface. See, e.g., "Effect of Elevated Temperatures on Erucamide Partitioning in Polyolefin Films", C. Shuler, A. Janorkar and D. Hirt, Clemson University.

Still further, nothing in Chang '822 teaches or suggests the other combinations of features explicitly recited in claims 4 and 9. For example, claim 4 requires:

"between 25 ppm and 5000 ppm and preferably between 100 ppm to 1000 ppm of a primary amide of general structure R-CO-NH₂ and between 25 ppm and 5000 ppm and preferably between 100 ppm to 1000 ppm of a secondary primary amide or blend of secondary amides of general structure R-CO-NH-R' where the R and R' can include any of erucic, oleic, palmitic, behemic, capric, lauric or stearic functional groups of between 9 to 30 carbon atoms, such that the ratio of primary amide to secondary amide is between about 1:1 and 1:3."

This combination of features is neither taught nor suggested by Chang '822.

The assertion that "it would have been obvious to one of ordinary skill in the art to optimize" in the precise manner called for by claims 4 and 9 appears to have no basis but hindsight reconstruction – and moreover, ignores the complete absence in Chang '822 of a teaching or suggestion of the use of a secondary amide.

Even if the claimed invention could fairly be termed "an optimization" (and it is not merely "an optimization", given its recognition of the use of a secondary amide in the particular manner claimed), the history of U.S. patents is replete with examples of optimizations that, because they are not disclosed or suggested by the prior art, advanced the technology and are entitled to patent protection. There is no basis in the patent statute that optimizations *per se* should not be patentable, and 35 USC 103(a)

itself negates the argument set forth in the Action, stating that "patentability shall not be negated by the manner in which the invention was made" – i.e., the mere fact that the invention was arrived at through extensive experimentation rather than the old requirement of a "flash of genius" does not render the subject matter unpatentable.

Further evidence of the non-obviousness of the claimed aspects of the invention, the desirability of the invention, and the absence of such features from the prior art, is provided by the attached article, N. Savargaonkar et al., "Slip Agents: Extended Performance Range For Polyolefin Films", *Plastics Technology*, April 2006. (Article also available at: www.plasticstechnology.com/articles/200604fa2.html) . This article points out the desirability of the COF control features that are discussed above in connection with the amended claims; the fact that those combinations of features were not available using conventional agents; the commercial desirability of such features; and the marked differences between migratory and non-migratory agents. (It is noted that the Ampacet Product 102794 cited in the article as new is in fact secondary amide (stearyl erucamide) alone, without any primary amide (erucamide) added.)

The combinations of features recited in claims 4 and 9 are neither taught nor suggested by Chang '822, and therefore these claims distinguish patentably over Chang '822. Allowance of these claims is respectfully requested.

Rejection of claims 6 and 11 as being allegedly obvious in view of Chang '822 in view of Creekmore:

The Action admits that "Chang does not explicitly disclose a secondary amide such as oleic palmitamide"; but then goes on to allege that "Creekmore teaches a film comprising stearyl erucamide and oleic palmitamide (abstract, column 2, lines 1-15 and column 5, lines 8-20) where the polymeric film has a thickness of 0.5 – 20 mil (column 1, lines 7-8 and lines 40-42). The film of Creekmore comprises polyethylene (column 3, lines 47-48). Chang and Creekmore are both related to thin polymeric films. Therefore, it would have been obvious to one of ordinary skill in the art to have employed the stearyl erucamide and oleic palmitamide, as taught in Creekmore, in the polymeric film of Chang because the stearyl erucamide and oleic palmitamide material provides improved surface smoothness of the polymeric film."

In addition to the remarks set forth above, which make clear that Chang '822 fails to disclose any use of a secondary amide, the Applicant notes that claims 6 and 11 are cancelled in the present amendment, thus obviating this ground of rejection. The

recitations of these claims have been incorporated into amended independent claims 1 and 7 by the present amendment, and as discussed above, the amended independent claims 1 and 7, and their dependent claims, recite combinations of features that are neither taught nor suggested by Chang '822 or Creekmore, taken separately or in combination, and are thus patentable over the cited art.

Still further, with regard to the rejection of claims 6 and 11 as being allegedly obvious in view of a combination of Chang '822 and Creekmore, the Applicant respectfully disagrees with the assertion that Creekmore teaches a film comprising polyethylene. Creekmore only indicates polyethylene as an processing additive, along with several other ingredients to be added at very low levels, and never discusses a film that is substantially composed of polyethylene. More particularly, Creekmore by its explicit teachings is directed to films composed substantially of rubbers, and even if it were legitimate to combine the teachings of Creekmore and Chan '822, the result would not teach or suggest the combinations of features required by the amended claims in their entireties.

Conclusions:

The present response is deemed to attend to each point raised in the outstanding Action. The present response amends the claims to more particularly claim features of the present invention. No new matter has been added, and support for the new claims is found in the specification and drawings as filed. The Examiner is respectfully requested to allow the claims and pass the application through to issuance. Should questions arise, the Examiner is respectfully invited to contact the undersigned.

The Applicant and the undersigned counsel would appreciate the opportunity to discuss the claims with the Examiner in an in-person interview, and to this end, the undersigned will contact the Examiner by telephone to see if a mutually convenient date and time for such an in-person interview can be established.

Respectfully submitted,



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Attached:

- Diagram
- Plastics Technology Article
- Excerpt from Morrison et al. Text

PlasticsTechnology

<http://www.plasticstechnology.com/articles/200604fa2.html>

April 2006

Feature Article

Slip Agents: Extended Performance Range For Polyolefin Films

Newer specialty slip masterbatches go beyond traditional capabilities to provide greater thermal stability, reliability, and ability to hold COF steady during laminating.

By N. Savargaonkar & B. McKinley, Ampacet Corp.

Today's slip masterbatch additives for LDPE, LLDPE, and other polyolefin films offer a wider range of performance capabilities than in the past. These products range from the traditional amide slips—the predominant grades now in use—to newer specialty, non-migratory grades that can meet such needs as the ability to work well at higher temperature, improve reliability, and hold coefficient of friction (COF) steady before and after laminating. Processors should be aware of newer alternatives that overcome slips' previous limitations.

Slip agents overcome the resins' natural tackiness so they can move smoothly through converting and packaging equipment. LDPE and LLDPE films are commonly categorized as low-, medium-, or high-slip, depending on their COF. The COF level generally corresponds to how much slip they contain (see Table 1).

TABLE 1—SLIP LEVEL VS. COF		
	COF	Slip ppm
Low Slip	0.50-0.80	200-400
Medium Slip	0.20-0.40	500-600
High Slip	0.05-0.20	700-1000

Slip masterbatches are available in formulations that allow for various diffusion rates, end-use temperatures, base resins, and ink types. Traditional slips are based on unsaturated fatty acid amides, most commonly oleamide and erucamide. These primary amides migrate rapidly through polyolefin films after extrusion and appear on the surface of the film to lower the COF.

Other slips based on secondary amides have almost twice the molecular weight of primary amides and thus migrate more slowly in polyolefins. Traditional primary and secondary amides are offered commercially in LDPE, LLDPE, and mLLDPE carriers.

The newer slip masterbatches include non-migratory slips with very large molecules and specialized formulations adapted for lamination. Specialty grades may be comprised of blends of primary slips or primary and secondary amide slips, as well as a variety of carrier resins such as PP, EMA, and EVA.

Standard migratory slips

Film producers tend to rely on amide slips because they lower COF at a reasonable cost. Primary and secondary amide slips allow processors to select COF's between 0.1 and 0.4.

Migratory slip concentration in a masterbatch is typically 5% to 10%. Migratory slip concentrations typically range from 200 to 2000 ppm in actual films. Thinner films generally demand higher slip concentrations to attain a given COF. Erucamide is more widely used because it is derived from non-animal sources and tends to be somewhat more thermally stable than oleamide.

Films need a conditioning period after extrusion so that equilibrium can be established between the slip on a film's surface and that in its interior. Since most of the COF reduction occurs within the first day (Table 2), COF in LDPE and LLDPE films is usually measured 24 hr after extrusion.

TABLE 2—COF CHANGE OVER TIME

Time	COF @ 1000 ppm Slip		COF @ 500 ppm Slip	
	Erucamide	Oleamide	Erucamide	Oleamide
2 min	0.33	0.3	0.43	0.38
7 min	0.28	0.26	0.37	0.32
20 min	0.24	0.23	0.31	0.27
45 min	0.2	0.2	0.26	0.24
90 min	0.18	0.19	0.23	0.23
1 day	0.15	0.17	0.2	0.23

The COF and slip migration rate are usually tailored for the end use. Faster slip diffusion is important for in-line forming and converting into bags and other products. Slower slip diffusion is needed for roll stock so that the COF does not fall too quickly and cause winding difficulties and telescoping of rolls.

Migration factors

Many variables influence migration rate and ultimate COF. Diffusion in a polymer is faster with smaller slip molecules and higher concentrations. The nature of the polymer is also important. Slip molecules diffuse mainly through amorphous regions of a polyolefin, so migration is slower in more crystalline resins like HDPE and PP than in LDPE or LLDPE.

Highly amorphous and tacky polymers, such as lower density mLLDPE grades (<0.92 g/cc) require high loadings of slip. Polar polymers like EVA or EMA can interact with the functional groups of a slip and retard its migration.

Migration of slips through polyolefins is slower in a wound roll than an unwound one. The greater the winding tension, the slower the diffusion rates.

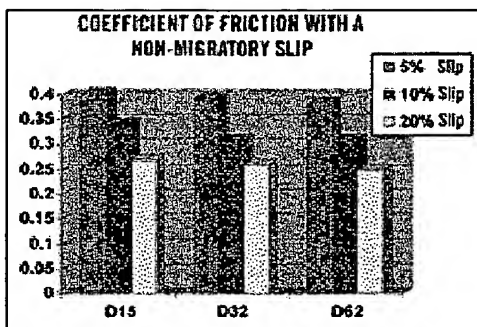


Fig. 1— Non-migratory slips show little change in COF over 62 days, eliminating one process variable (Ampacet 101501 masterbatch in 2-mil bilayer LDPE cast film.)

Also, antistats and antifogs can compete with slips for surface sites and during diffusion. These additives have larger molecules than primary amide slips, so they migrate more slowly. Some antiblocks may adsorb slip molecules and adversely affect their diffusion.

Downstream processing may also affect COF. For instance, corona treatment prior to printing burns off the surface slip layer and makes the surface polar. As a result, more slip migrates toward the corona-treated side than to the untreated one.

Primary amide slips have thermal limitations. While they work well in blown films processed at 400 F, they tend to volatilize at higher temperatures. They are not suitable for use with cast films, which are typically made at 500 F to 550 F, or in extrusion coating, which is commonly done at 600 F. This also applies to films that must pass over hot metal machine elements.

Secondary amide slips have better thermal performance and are used at higher temperatures. They migrate more slowly than their primary amide counterparts and hence provide better control of COF. They are also less likely to interfere with printing and heat sealing. Secondary amides are sometimes chosen when balancing slip and antiblock properties is critical.

Non-migratory slips

Introduced in the late 1990s, non-migratory slips have molecular weights 30 to 50 times greater than primary and secondary amides. Their large size does not allow them to diffuse through a polymer, so their COF reduction is provided by the slip molecules that end up on the surface during extrusion.

As a result, they need no conditioning period and their lubricity remains relatively steady as a film passes through lamination, converting, printing, shipping, and other steps. The COF they provide also tends to be more uniform across the film than with primary amide slips.

Non-migratory slips typically yield COFs from 0.20 to 0.40, depending on use level (Table 3). Consistency of COF from 15 to 62 days after casting LDPE with a non-migratory slip is shown in Fig. 1.

Unlike migratory slips, these types are only needed in the outer layers of multilayer films. That makes non-migratory slips more cost-effective in multilayer films, even though higher levels (1% to 2%) are required in those outer layers. Non-migratory slips reduce the need to overdose the amount of slip to create a reservoir in the film to allow sufficient migration to the surface. Also, the consistent COF with non-migratory slips eliminates one process variable, which helps reduce rejects during converting.

TABLE 3—CHANGE IN COF WITH NON-MIGRATORY SLIP

Slip %	COF
5	0.39
7.5	0.34
10	0.31
15	0.27
20	0.26

Non-migratory slips are stable at high temperature and may not adversely affect the heat sealing of a PE film if done at the appropriate temperature. They can also be used in cast films and withstand the elevated temperatures of hot filling, shrink tunnels, and other operations. Films made with non-migratory slips have good seal strength. For instance, the seal strength of a 2-mil, two-layer LDPE cast film with a non-migratory slip only in the sealant layer was 2423 psi with addition of 10% slip masterbatch and 2491 psi with 20% slip masterbatch.

Non-migratory slip masterbatches are available with 10% and 20% slip for LLDPE blown films, LDPE cast films and extrusion coatings, and PP cast films. These slips can transfer across film surfaces on tightly wound rolls and they reduce film clarity more than primary or secondary amides.

New for lamination

The COF of polyethylene films containing erucamide slip agent often rises when the films are adhesively laminated to other films. This is believed to occur because erucamide is attracted to the adhesives or to the polar substrates such as PET or nylon used in adhesive lamination.

The slip drawn away from the PE sealant surface can cause the COF to increase to 1.0 or more, which makes film movement more difficult through vertical form-fill-seal, printing, and other converting equipment. The loss of COF is more pronounced in laminated films that sit for a time before being converted or printed.

A recently introduced type of slip can avert this problem by remaining in the PE layer. Thirty-day tests found that one such slip (Ampacet 102794) holds COF steady before and after lamination (Fig. 2). This slip was compared with a conventional erucamide and a non-migratory slip in 2-mil films with a three-layer coextruded structure commonly found in flexible food packaging—mLLDPE seal layer plus two octene-LLDPE layers. The films were laminated to a PET film with a solvent-based polyurethane adhesive.

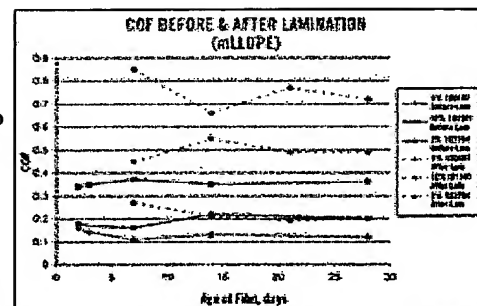


Fig. 2—Tests with a new type of slip agent (Ampacet 102794) show consistent COF before and after lamination, unlike a standard 1% erucamide (Ampacet 100497) and a non-migratory slip (Ampacet 101501). Three-layer, 2-mil, coextruded films with an mLLDPE sealant layer and two octene-LLDPE layers were laminated to PET with a solvent-based PUR adhesive.

COF in the samples containing the new slip settled in at 0.2 before and after lamination. COF in the films with the standard erucamide jumped more than five-fold to between 0.68 and 0.85 after lamination, while COF in films with the non-migratory slip rose modestly from about 0.35 to about 0.5.

Experience indicates that the new slip formulation should perform similarly in other film structures, such as coextruded LLDPE films with an EVA sealant layer. Ampacet 102794 is cost-effective because it can be used at a 2% letdown ratio. In addition, it does not need to be overdosed to compensate for slip lost in the sealant layer due to lamination.

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LIBRARY OF CONGRESS CATALOG CARD NUMBER: 72-91904

ISBN 0-205-03239-7



Fourteenth printing June, 1979

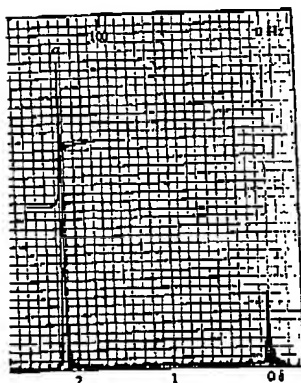
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CHAP. 21



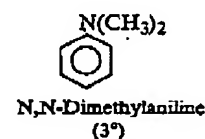
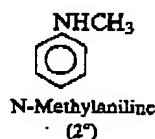
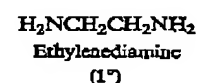
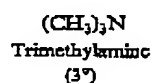
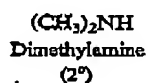
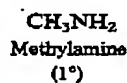
izoylacetone.

Chapter 22 Amines I. Preparation and Physical Properties

22.1 Structure

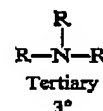
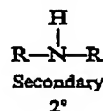
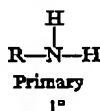
Nearly all the organic compounds that we have studied so far are bases, although very weak ones. Much of the chemistry of alcohols, ethers, esters, and even of alkenes and aromatic hydrocarbons is understandable in terms of the basicity of these compounds.

Of the organic compounds that show appreciable basicity (for example, those strong enough to turn litmus blue), by far the most important are the amines. An amine has the general formula RNH_2 , R_2NH , or R_3N , where R is any alkyl or aryl group. For example:



22.2 Classification

Amines are classified as primary, secondary, or tertiary, according to the number of groups attached to the nitrogen atom.



727

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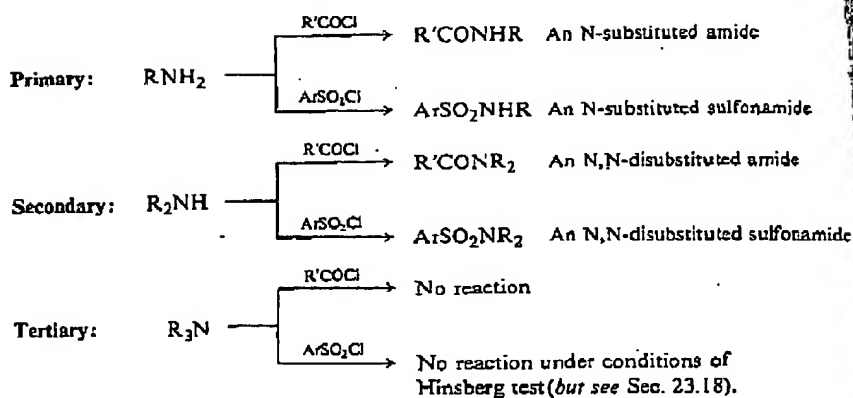
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AMINES II. REACTIONS

CHAP. 23

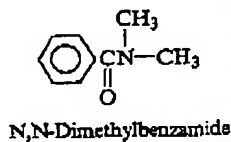
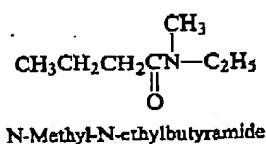
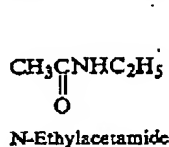
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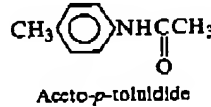
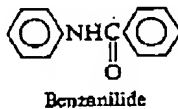


Tertiary amines, although basic, fail to yield amides, presumably because they cannot lose a proton (to stabilize the product) after attaching themselves to carbon or to sulfur. Here is a reaction which requires not only that amines be basic, but also that they possess a hydrogen atom attached to nitrogen. (However, see Sec. 23.19.)

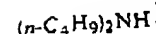
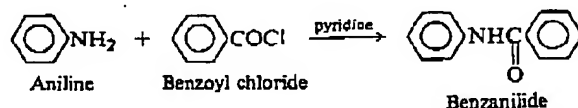
Substituted amides are generally named as derivatives of the unsubstituted amides. For example:



In many cases, and particularly where aromatic amines are involved, we are more interested in the amine from which the amide is derived than in the acyl group. In these cases the substituted amide is named as an acyl derivative of the amine. For example:

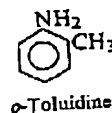


Substituted amides of aromatic carboxylic acids or of sulfonic acids are prepared by the Schotten-Baumann technique: the acid chloride is added to the amine in the presence of a base, either aqueous sodium hydroxide or pyridine. For example:

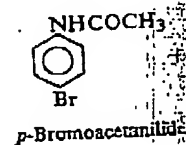
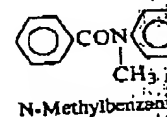


Di-n-butylamine

Acetylation is generally done with acetyl chloride. For example:



Like simple amides, the acid and the amine react upon the acidity or alkali.



Sulfonamides are examined in the next section. Nucleophilic attack is unhindered; it involves the nitrogen. Nucleophilic attack is hindered; it involves the sulfur.

R-C

Trigonal bipyramidal

O

Ar-S

Tetrahedral

